PHB/Sugarcane bagasse composite for controlled release fertilizer.

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Abstract

A green material based on PHB and sugarcane bagasse as controlled release fertilizer obtained by mechanical mixture.

Introduction

The development of materials for controlled release fertilizers reduces the loss problems through leaching and soil contamination without affecting the growth of the culture, increasing the fertilizer efficiency[1]. Controlled release materials were prepared with a biodegradable polymer-based PHB (Poly - 3 - hydroxybutyrate)[2] which is obtained from renewable sources. Natural fiber as sugarcane bagasse (B) was incorporated, which can increase the strength of the material, besides reducing the cost by using an abundant byproduct in the country. Potassium nitrate (KNO_3) was used as standard fertilizer easier to monitor the release. Corn starch (CS) is used to help in material biodegradation in soil as a carbon source and glycerin (G) as polymer plasticizer. PHB, CS and G were used in a mass proportions of 50/35/15 and 2, 4, 6, 8, 10 and 30 % of bagasse were used. 10% of KNO_3 was added for all formulations. All substances were added to the mixer at the same time. The composites were thermal processed in an internal mixer at rheometer Haake at 165 °C, 50 rpm for 5 min. The fertilizer release test was conducted in water and quantified by conductivimetry.

Results and discussion

Figure 1 shows the fertilizer release in water over time for PHB-B in different proportions. Based on conductivity results no abrupt bagasse influence is observed. For higher amount of bagasse (PHB-B30%) a slower release in the early hours is observed. PHB-B10% composite has a lower release compared to the others. Figure 2 shows a SEM morphology. The bright phases refer to the fertilizer and the dark one to the PHB-B. Two different phases of PHB and bagasse is observed (see arrow in Figure 2) and it is observed the preference of the KNO_3 for bagasse phase. Higher amount of bagasse shows a more homogeneity material. This morphology explains the desorption results since the fertilizer is more available.

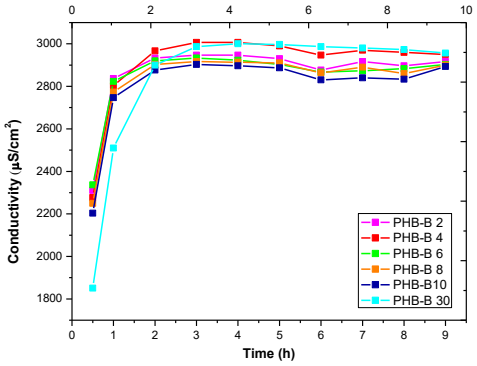

Figure 1. KNO_3 release for different proportions of sugarcane bagasse.

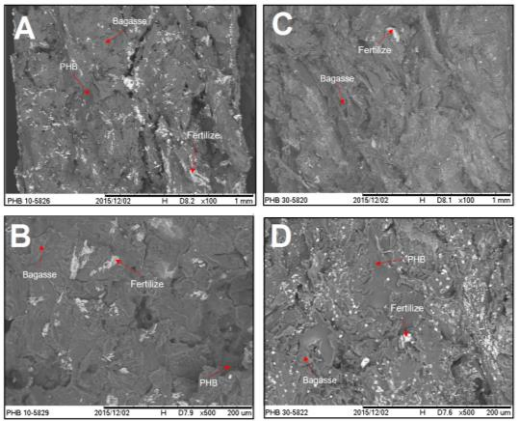

Figure 2: SEM of the composite surface PHB-B10% (A, B) and PHB-B30% (C, D).

Conclusion

It can be considered that there was no significant difference in fertilizer release with increasing percentage of sugarcane bagasse since the KNO_3 cover the bagasse phase.

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